

REMARKS

Claims 29-41 are currently pending in the present application.

Claims 29 and 34 have been amended to more particularly point out and distinctly claim various embodiments of Applicants' invention wherein the claimed films are disposed on a silicon substrate. Support for the amendments made herein can be found throughout the Specification, including the Examples, for example, at page 4, line 28 through page 5, line 16 and in the Figures. The amendments made herein introduce no new matter. Additionally, a complete listing of all claims ever presented is set forth herein in accordance with 37 C.F.R. §1.121(c)(1). Entry of the amendments made herein is respectfully requested.

Rejection Under 35 U.S.C. §112, 1<sup>st</sup> Paragraph:

In the Office Action, the Examiner rejects claims 29-38 and 40 under 35 U.S.C. §112, first paragraph, as lacking enablement. With respect to claims 29 and 34, the Examiner contends that the claims are directed to free-standing tantalum films as no substrate or underlying structure is recited. The Examiner argues that the Specification does not enable the production of free-standing films. With respect to claims 29 and 38, the Examiner contends that the claims are directed to tantalum films with a single crystal structure and no grain boundaries. The Examiner argues that the Specification does not enable the production of such a single crystal film having no grain boundaries. Dependent claims 30-33, 35-37 and 40 are rejected as being dependent upon a rejected base claim. Applicants respectfully traverse the Examiner's rejection and the arguments and contentions set forth in support thereof for at least the following reasons.

First, while not necessarily agreeing that free standing films are not enabled, nor that the claimed films do not necessarily imply an underlying substrate if not free-standing, in an effort to expedite prosecution of certain embodiments wherein the inventive film is disposed on a substrate, Applicants have amended claims 29 and 34 accordingly. Reconsideration and withdrawal of the rejection in this regard are respectfully requested.

As to the issue concerning disclosure of a single crystal tantalum film with no grain boundaries, Applicants respectfully disagree with the Examiner's assessment of the disclosure. Not only do Applicants sufficiently describe "how to achieve these single crystal tantalum films," as acknowledged by the Examiner, but Applicants do in fact provide working examples. (*See*, the Office Action, p. 3). Thus, even though the absence of a working example is not *per se* a basis for non-enablement, Applicants describe in the Examples beginning at page 10, line 7, the production and characterization of amorphous and single crystal tantalum films. In discussing the spectroscopic characterization thereof, Applicants state that the amorphous and single crystal tantalum films provide a far superior diffusion barrier than polycrystalline films containing grain boundaries. In other words, the amorphous and single crystal tantalum films prepared and evaluated in the working examples of the Specification do NOT contain grain boundaries. Thus, the Examiner's contentions underlying the enablement rejection in this regard are incorrect. Reconsideration and withdrawal of the rejection are respectfully requested.

Applicants submit that all pending claims comply with 35 U.S.C. §112, first paragraph.

Prior Art Rejections:

In the Office Action, the Examiner rejects claims 29-33 under 35 U.S.C. §102(b) as anticipated by, or in the alternative, under 35 U.S.C. §103(a), as obvious over the Marcus article entitled "Electrical and Structural Properties of Epitaxial bcc Tantalum Films" ("Marcus"). Additionally, the Examiner rejects claims 34-37, 39 and 41 as anticipated by, or in the alternative, as obvious over U.S. Patent No. 6,057,237 of Ding, *et al.* ("Ding"). Applicants respectfully traverse the Examiner's rejections and the argument and contention set forth in support thereof for at least the following reasons.

Applicants have amended claims 29 and 34 to specify that the recited tantalum film is disposed on a silicon substrate. Marcus is directed to deposition of a tantalum film on

cleaved magnesium oxide. Marcus does not teach, or even suggest the claimed tantalum films disposed on a silicon substrate, nor does Marcus provide guidance as to deposition thereon. Marcus clearly fails to anticipate the claimed invention, and further fails to satisfy the criteria necessary to establish *prima facie* obviousness. Marcus does not suggest the claimed invention, nor does the reference motivate one of ordinary skill in the art to modify it as would be needed to arrive at the claimed invention. Withdrawal of the rejection on the basis of the Marcus reference is respectfully requested.

Contrary to the Examiner's assertions, Ding does not teach amorphous tantalum films with no grain boundaries. As clearly described in Ding, the tantalum films prepared therein are crystalline and the addition of a tantalum nitride layer sandwiched between tantalum layers decreases crystallinity. (*See*, Ding, col. 2, lines 54-62). Thus, a crystalline tantalum layer which "becomes less crystalline" is described, not an amorphous film with no grain boundaries. (*See, id.*). Applicants respectfully submit that Ding fails to anticipate the claimed invention or satisfy the criteria necessary to establish *prima facie* obviousness. Withdrawal of the rejection based on Ding is respectfully requested.

Claim 38 is rejected as being obvious over the Stavrev article entitled "Behavior of Thin Film Ta-Based Films in the Copper/Barrier/Si System," further in view of U.S. Patent No. 4,372,989 of Menzel. Claim 40 is rejected as being obvious over the Stavrev article in view of Menzel and U.S. Patent No. 6,531,780 of Woo, *et al.* Applicants respectfully traverse the Examiner's rejections and the arguments and contentions set forth in support thereof for at least the following reasons.

Applicants submit that Menzel fails to remedy the deficiencies of the Stavrev article. Menzel is directed to increasing grain size by a focused beam of energy, *i.e.*, laser induced recrystallization. Menzel describes "controlled beam guidance" such that the crystallization (*i.e.*, increase in grain size) can be "extended uniformly in a desired path . . . ." (*See*, Menzel, Abstract). One of ordinary skill in the art would have no reason to apply the

focused laser induced recrystallization employed to increase grain size in an already deposited film of Menzel, in the generic ideal study of Stavrev. Accordingly, neither cited combination satisfies the criteria necessary to establish *prima facie* obviousness. Withdrawal of the rejections are respectfully requested.

None of the cited references teaches, let alone suggests, the claimed tantalum thin films having no grain boundaries with the recited microstructure characteristics. There is nothing in any of the cited references to motivate one of ordinary skill in the art to modify their teachings in order to arrive at Applicants' claimed invention. Furthermore, one of ordinary skill in the art would have no reasonable expectation of successfully preparing such tantalum films based on the teachings of the references.

Accordingly, Applicants submit that none of the cited references anticipates the claimed invention or satisfies the criteria necessary to establish *prima facie* obviousness as to the claimed invention.

In conclusion, Applicants respectfully submit that all pending claims patentably distinguish over the prior art of record. Reconsideration, withdrawal of the rejections and a Notice of Allowance are respectfully requested.

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Respectfully submitted,

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